**IN THE CLAIMS:**

1. **(Currently Amended)** A speed sensing system for measuring the speed of a target object, comprising:

a first differential speed sensor unit operatively disposed adjacent a surface of said target object, said first differential speed sensor unit configured to generate a first differential signal responsive to the passage of at least one random feature of said target object;

a second differential speed sensor unit operatively disposed adjacent a surface of said target object and displaced at a predetermined distance from said first differential speed sensor unit substantially in a direction of motion of the target object, said second differential speed sensor unit configured to generate a second differential signal responsive to the passage of said at least one random feature of said target object; and

a signal processor configured to receive said first and second differential signals, said signal processor further configured to apply a cross correlation analysis ~~with a Fast Fourier Transform based algorithm~~ to determine a phase shift between said first and second ~~generated~~ differential signals, said phase shift inversely proportional to a speed of said target object.

2. **(Cancelled)**

3. **(Cancelled)**

4. **(Cancelled)**

5. **(Currently Amended)** The speed sensing system of Claim 1 wherein said first and second differential speed ~~sensing~~ sensor units ~~are~~ each include at least one eddy current ~~sensors~~ sensor; and

wherein said at least one feature is a random subsurface target feature.

6. **(Currently Amended)** The speed sensing system of Claim 1 wherein said first and second ~~speed sensing~~ differential speed sensor units ~~are~~ each include at least one optical ~~sensors~~ sensor.

7. **(Currently Amended)** The speed sensing system of Claim 1 wherein said signal processor is configured to filter direct-current components from said first and second generated differential signals such that said generated differential signals have a zero signal mean.

8. **(Currently Amended)** The speed sensing system of Claim 1 wherein said signal processor is configured utilize a Fast Fourier Transform-based algorithm to determine a cross correlation function between said generated differential signals, said cross correlation function defined by:

$$y(\tau) = \int x_1(t+\tau) \cdot x_2(t) dt$$

where

$x_1$ is said first generated differential signal;

$x_2$ is said second generated differential signal;

$t$ is a signal time; and

$\tau$ is a time delay between said generated differential signals.

9. **(Original)** The speed sensing system of Claim 8 wherein said phase shift is associated with a maximum value for said cross correlation function; and wherein said signal processor is further configured to determine a maximum value for said cross correlation function;

wherein a speed *v* of said target object is determined from:

$$v = \frac{L}{\tau_0}$$

where L is said predetermined distance; and

$\tau_0$ is a time delay corresponding to said determined maximum value for said cross correlation function.

10. **(Currently Amended)** The speed sensing system of Claim 1 wherein said first differential speed sensor unit and said second differential speed sensor unit are disposed within a common housing.

11. **(Currently Amended)** The speed sensing system of Claim 1 wherein said at least one random target feature is a ~~random~~ surface feature of the target object.

12. **(Currently Amended)** The speed sensing system of Claim 1 wherein said at least one random target feature is a ~~random~~ subsurface feature of the target object.

13. **(Currently Amended)** The speed sensing system of Claim 1 where each of said first and second differential speed sensing units has an identical sampling rate; and

wherein said identical sampling rate is substantially greater than a signal variation rate for said first and second differential speed sensing units.

**14. (Currently Amended)** A method for speed measurement of a target object, comprising the steps of:

observing at a first point, a passage of at least one random feature of the target object;

generating a first signal responsive to said passage of said at least one random feature at said first point;

observing at a second point, displaced at a predetermined distance from said first point in a direction of motion of said target object, said passage of said at least one random feature of the target object;

generating a second signal responsive to said passage of said at least one random feature at said second point;

observing at a third point, displaced from said first point at least perpendicularly to the motion of said target object, a passage of at least one additional random feature of the target object;

generating a third signal responsive to said passage of said at least one additional random feature of the target object;

observing at a fourth point, displaced at said predetermined distance from said third point in a direction of motion of said target object, said passage of said at least one additional random feature of the target object;

generating a fourth signal responsive to said passage of said at least one additional random feature at said second point;

determining a first differential signal from said first and third generated signals;

determining a second differential signal from said second and fourth generated signals;

filtering direct-current components from said first and second ~~generates~~ differential signals;

applying a cross correlation analysis with a Fast Fourier Transform-based algorithm to calculate a phase shift between said filtered first ~~signal and said filtered second signal~~ and second differential signals, said phase shift inversely proportional to a speed of said target object.

**15. (Currently Amended)** The method of Claim 14 for speed measurement of an object wherein said phase shift is associated with a maximum value of a cross correlation function between said filtered first and second ~~generated~~ differential signals, and wherein said step of applying further includes calculating said maximum value of said cross correlation function between said filtered first and second ~~generated~~ differential signals, said cross correlation function defined by:

$$y(\tau) = \int x_1(t+\tau) \cdot x_2(t) dt$$

where $x_1$ is said first ~~generated~~ differential signal;

$x_2$ is said second generated differential signal;

$t$ is a signal time; and

$\tau$ is a time delay between said ~~generated~~ first and second differential signals.

**16. (Original)** The method of Claim 15 for speed measurement of an object, further including the step of determining a speed $v$ of said target object from:

$$v = \frac{L}{\tau_0}$$

where L is said predetermined distance;

and $\tau_0$ is a time delay corresponding to said determined maximum value for said cross correlation function.

**17. (Cancelled)**

**18. (Original)** A method of Claim 14 for speed measurement of a target object further including the step of:

determining a relative position of the target object from said calculated phase shift.

**19. (Original)** The method of Claim 18 for determining a relative position of a target object wherein said determining step includes the step of integrating a calculated speed of said the target object with respect to time.

**20. (New)** The speed sensing system of Claim 1 wherein said first differential speed sensor unit includes first and second speed sensors spaced at least perpendicular to a direction of motion of the target object, each of said first and second speed sensors configured to generate a signal responsive to the passage of at least one feature of said target;

wherein said second differential speed sensor unit includes third and fourth speed sensors spaced at least perpendicular to a direction of motion of the target object, each of said third and fourth speed sensor units configured to generate a signal responsive to the passage of at least one feature of said target object;

wherein said first and third speed sensors are disposed along a common line parallel to the direction of motion of the target object;

wherein said second and fourth speed sensors are disposed on a second common line parallel to the motion of the target object;

wherein said first differential signal is representative of a difference between said signals generated by said first and second speed sensors; and

wherein said second differential signal is representative of a difference between said signals generated by said third and fourth speed sensors.

**21. (New)** The speed sensing system of Claim 20 wherein said signal processor is configured to cancel signal components common to said signals generated by said first, second, third, and fourth speed sensors.

**22. (New)** The speed sensing system of Claim 20 wherein said first and third speed sensors are configured to observe surface features of said target object; and

wherein said second and fourth speed sensors are configured to observe subsurface features of said target object.

**23. (New)** The speed sensing system of Claim 20 wherein said first, second, third, and fourth speed sensors define a parallelogram having two sides parallel to the direction of motion of said target object.

**24. (New)** The speed sensing system of Claim 23 wherein said first, second, third, and fourth speed sensors define a rectangle having two sides perpendicular to the direction of motion of said target object.